

# Fab Lab Amersfoort, De War:

## An Innovation History



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Report prepared by Sabine Hielscher on behalf of the Centre on Innovation and Energy Demand (CIED) as part of the Grassroots Innovation in Low Energy Digital Fabrication project

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The Centre on Innovation and Energy Demand (CIED) contributes to this challenge by developing a socio-technical understanding of the *emergence, diffusion* and *impact* of low energy innovations. These include new technologies (e.g. heat pumps), organisational arrangements (e.g. car sharing) and modes of behaviour (e.g. cycling) that are expected to improve energy efficiency and/or reduce energy demand. In this project we are interested in FabLabs as a site for exploring energy demand implications of digital fabrication.

CIED is a collaboration between researchers from the Sussex Energy Group (SEG) at SPRU, University of Sussex; the Transport Studies Unit (TSU) at the University of Oxford; and the Sustainable Consumption Institute (SCI) at the University of Manchester and is one of six Research Centres on End Use Energy Demand funded by the RCUK Energy Programme.

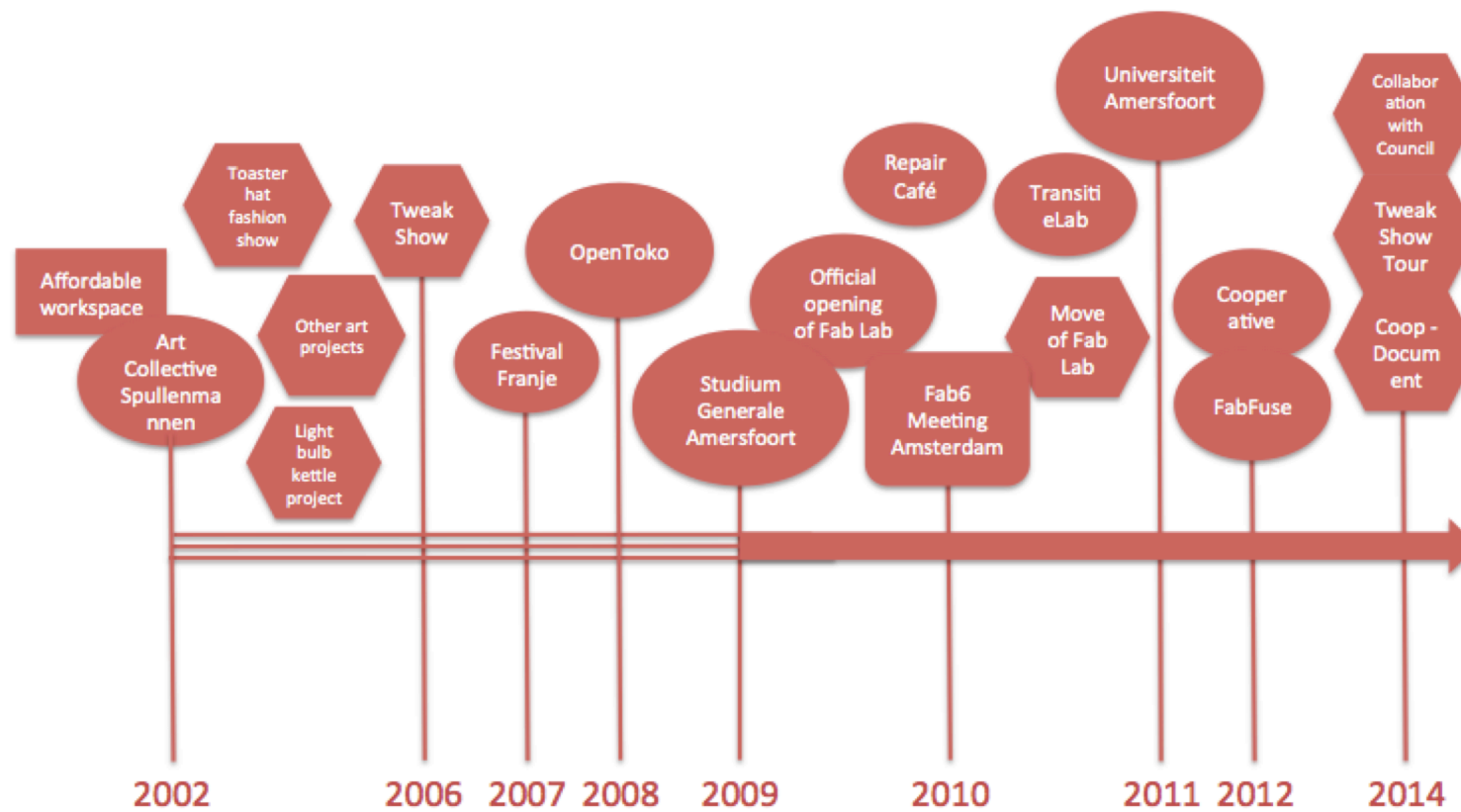
## **Amersfoort Fab Lab, De War**

Four artists set up Fab Lab Amersfoort in 2010. They were interested in the intersections of art, technology, sustainability and science, and were intrigued by the possibilities of the Fab Lab concept. They struggled to gain external funding for their Fab Lab, and consequently, decided to take matters into their own hands and set up the lab with their own money. Since then, the Fab Lab has become well known internationally as a bottom up, grassroots workshop because they were able to set up the lab in '7 days with 4 people and about €5000'. Part of their approach and aspiration is to use mainly self-built and open source machines in their lab, to become sustainable (drawing on ideas coming from Transition Towns and Citizen Science) and develop experiments towards a peer-to-peer society. The Fab Lab is part of a cooperative called 'De War' and is strongly connected to the following activities: Transitielab, OpenToko, Spullenmannen and Amersfoort University. These organisations, projects and activities are intricately connected with each other. The practitioners regard them as inseparable. This Innovation History will therefore not only draw on insights gained from visiting Fab Lab Amersfoort but also puts them in the context of De War.

### **Key Insights**

For the Grassroots Innovation in Low Energy Digital Fabrication project, the Fab Lab Amersfoort is particularly interesting because, through its novel approach to thinking about sustainability and change, it reveals a number of issues important to digital fabrication in relation to energy and sustainability. In particular:

- Sustainability and energy demand concerns amongst grassroots digital fabrication practitioners globally are isolated and relatively sparse. Examples are hacking smart meters and self-building renewable energy systems that are sometimes imbued with social visions and aims – Fab Lab Amersfoort is, in addition to some other labs (e.g. [WeCreate](#) in Ireland, [Valldaura](#) near Barcelona), relatively exceptional in the network.
- At Fab Lab Amersfoort, and particularly in the projects of De War, the emphasis is in using the tools of the Lab for the purposes of social change and sustainability. The facilities are used to make objects such as monitoring systems. But really it is the organisation of these activities, and how they connect to bigger ideas and community building that is important. De War at Fab Lab Amersfoort is seeking to put into practice ideas about open design, peer-to-peer production, and local sustainability.
- Finally, the way they are trying to insert the innovative possibilities of Fab Labs into Transition Town activities and in other directions of change they seek (such as citizen science, and an open, collaborative and sustainable society generally) is by embedding the Lab into networks of local activity that are working in similar directions. Transformation rests in the new relationships built through these networking activities.



Amersfoort Fab Lab, De War Timeline



## CIED project on emergence: Grassroots Innovation in Low Energy Digital Fabrication

Rapid advances in open-source, small-scale digital design and fabrication technologies are opening up new possibilities for decentralised, networked, user-led manufacturing. A confluence of new technologies (e.g. the 3-D printing 'revolution'), new business models (e.g. 'personalised manufacturing'), and new social movements (e.g. 'open-source, commons-based, peer-production'), are prompting claims about the 'reconfiguration' of production and consumption. For example, proponents talk about: a 'third industrial revolution', transforming the material world in ways analogous to ICT for information; the 'democratisation of manufacturing'; 'unlocking grassroots innovation'; and 'sustainable, localised production-consumption loops'.

Growing numbers of individuals, firms, and civil associations are experimenting with digital fabrication within 'maker-spaces'. These spaces are networks of workshops that provide technologies, materials, training, and access to digital networks that enable participants to design and make a wide range of products, from jewellery to eco-houses, bicycles to wi-fi systems, and to encourage community-based projects such as up-cycling.

As yet, there has been little independent, social scientific analysis into the emerging possibilities in this area and their limitations, particularly for sustainable, low energy production and consumption patterns. As with any mode of production and consumption, energy demand and sustainability issues for decentralized digital fabrication are significant, and the consequences ambiguous.

For instance, whilst digital fabrication could potentially enable local production, remanufacturing, and increased longevity in goods and services, it could also lead to throw-away, personalised manufacturing that intensifies energy consumption. Moreover, decentralisation may reduce scale efficiencies, and require more dispersed logistics infrastructures in raw material shipping.

Our aim is to understand why there is so much interest in these developments, what contending narratives are influential in digital fabrication, how they are shaping material developments, what low energy innovations are arising, or potentially could arise in this setting, and how these developments could be shaped in a low energy direction.



Participant quotes

## Fab Lab Amersfoort, De War: An Innovation History

### A brief history of Fab Lab Amersfoort, De War

Fab Lab Amersfoort was officially opened in 2010. However, its history is ingrained in several other activities that are all located in an old factory building; the former food dye company Warner & Jenkins dating back to 1881, on the river Eem in Amersfoort. This community run space is called De War. Over the last nine years, it has been a hub for local sustainability, technology, science and art related initiatives. The space is a hub for several overlapping networks that vary in their formality and collaborate on activities. For instance, the Fab Lab is open to the public every Tuesday and is run by around 10 volunteers whereas the FabFuse event occurs yearly and is co-created between the organisers and attendees. For Harmen (who was there from the beginning) and Diana (who joined in 2005) the Fab Lab is an integral part of the De War activities and cannot be viewed separate from it (Fieldwork notes, Amersfoort Fab Lab, 25<sup>th</sup>-31<sup>st</sup> October 2014). Consequently, the start of Fab Lab Amersfoort begins with the history of De War.



So the history begins in 2001, when three friends created a theatre company, called the Spullenmannen in an old school building under the then existing anti-squatting measures. A year later, they had to leave the school and through a contact found the factory, which they have rented from the municipalities under anti-squatting law ever since. The arrangement means their tenure includes a three months notice period (which still exists now). At the beginning, they just wanted to find an affordable workspace to do their artwork (Fieldwork notes, Amersfoort Fab Lab, 25<sup>th</sup>-31<sup>st</sup> October 2014; Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014). The art practice of the Spullenmannen consisted of pieces relating to 'visual art' whilst dealing with 'absurd humour' and working with Spullen (i.e. things, stuff - often found or handed down objects that were discarded by

It was fascinating to see how much energy the group has put into reviving the factory – giving it a second life through looking after the infrastructure and creating socially and environmentally valuable projects. This becomes even more admirable when considering that they could get a letter from the municipals at any stage, saying that they would need to vacate the factory within three months time.

society) (see for instance, the art pieces called 'Ministry of Goods No Longer in Use' (see image below) or the 'Toaster Helmet Show').



'All these predictions about climate change, about peak oil, about food stock collapsing, whatever might happen, they are quite abstract if you are not used to this topic and this way of thinking. So then we thought we might be able to convert this theme, or this idea about, or knowledge about complex system into art, and at first we had this idea of making a number of interactive installations' (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014).

In 2005, one of the friends started 'withdrawing himself [from the activities] without explicitly saying so... there was no movement in the company and Harmen was a bit frustrated because he had to do everything himself' (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014). This was around the time when Diana visited De War for the first time. She decided to stay and help to get things going again. In addition to theatre, they started to produce interactive art installation and 'purposeless contraptions' (De War website, <http://dewar.nl/?en/home>), drawing on the intersections of art, technology and science (which is to this date still a strong focus). A particular focus of their artworks was on exploring topics of climate change, non-linear systems and complex behaviours which was triggered by a lecture that Harmen and Diana attended about complex systems and limits to growth by systems analyst and leader of the Limits to Growth report Dennis Meadows. The lecture was part of the 35 years anniversary of the Club of Rome.

'It taught us that you can hack systems that you can do that in a smart and lightweight fashion... And we also learnt very quickly that organisations then have two options in how to respond to such parasitic act. Either, be against and frustrated as much as you can or accept and cooperate... This experience gave us an idea of being bolder in how to achieve things... We discovered that it was empowering us, and a lot of other people' (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014).

Being partly frustrated about the lack of discussions around climate change in the media, Diana and Harmen started to wonder how they could translate such abstract models into a visual language for anyone to understand. This is how the 'Tweak Show' was born, a set of interactive art installations that they have been working on and showing to the public for the last eight years. The Tweak Show is 'a labyrinth full of interactive installations that give the audience an intuitive understanding of the complex systems in science, the environment and society' (Wildschut 2014). The first few pieces were shown at a Dutch festival in 2007. Building on this success, Diana and Harmen decided to enter the installations into an annual theatre festival in Amersfoort that is meant to showcase local art. They soon realised that the organisers 'were not interested' in showing their work (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014) and that they were not the only ones who experienced such a reaction. Soon after talking to some of the other artists who also got rejected, they gathered that they did not need the organisers but only 'the audience of the event'. As a response, they found fourteen artists who together with them created a 'fringe' festival next to the 'official' one, and set this up within three weeks of the opening of the latter. Although the organisers did not agree with this and got a civil servant involved, there was little they could do practically to close down the 'fringe' festival.

Finding loopholes in existing structures and not being deterred by setbacks seems to be a key characteristic for initiatives to realise projects.

Both, Diana and Harmen, defined this experience as a crucial one that helped them to define their approach to running De War.

Since then the festival (called Festival Franje) has been organised annually in Amersfoort as a 'fringe' event. A year later, Diana and Harmen did a tour of Europe with their 'Tweak Show' installations, contacting museums along the way to see whether they would show their work but often with little success. Nevertheless, they applied their learning and gate crashed one or two other events along the way, developing their 'guerrilla tactics and empowerment mechanisms' (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014). For Harmen, these early experiences 'were seeds for a lot of the methods that we [they] now use much more consciously' (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014).



'We discovered that there's lots of people who have little blocks of knowledge, and you yourself are probably one of them, and if you combine all that, suddenly everybody has a quick start initiative in a certain topic' (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014).

'And because it is about sharing it has a positive vibe. Some people that you do not know yourself personally, but get invited by others, will come to the meeting because of the sharing and social atmosphere for it. And they can get actually get knowledge from experts that you would otherwise pay for (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014).

One of the art pieces, called 'Braindetector' (see image above), in the Tweak Show was the initiator for another important key development. Although Diana and Harmen had previous knowledge in science, programming interactive videos and making and building things, this installation required them to translate brain activity into electricity and for them to have knowledge in neurology, which they did not have at the time. Consequently, they came up with the idea of facilitating a series of open workshops in the area of technology and art (such as about Arduino, open source hardware and programming) that they called 'OpenToko'. During the first 2008 OpenToko, they invited their friends, who also brought their friends along, to sit around the table and work on a common topic. At the beginning, they thought that they needed 'an expert' for each topic discussed whenever they met up; but soon they realised that their combined knowledge, research skills, and openness to self-directed learning meant that collectively they had enough brainpower to even tackle themes no one initially knew little about (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014). A side effect of these workshops was that created a network of people who were keen to exchange knowledge and skills.

In 2009, a Fab Lab regional networker came to De War and told them, 'listen guys, what you are doing is called a Fab Lab, you just don't know it yet and you should get some machines' (Zijp 2013). Fab Labs are community-based workshops, equipped with fabrication tools such as laser cutters, routers, and 3D printers, and where people innovate and learn together, using online networks to connect to open-source designs, tutorials and workshops globally. Harmen started to read Neil Gershenfeld's 'FAB' book and liked the idea. Even Diana felt that it would be good to be connected to the Fab Lab network. Diana and Harmen had already built upon networks of people locally to form a

It was interesting to hear how Diana and Harmen would not be discouraged by an idea, approach or project just because they did not have the knowledge or experience to do it.

group who exchanged knowledge around electronics and programming (i.e. the OpenToko), but the group did less around making. Using digital fabrication technologies, the latter was something the Fab Lab network could provide.

'So we are cake, and we got into the office, and we talked to them for a year, and still nothing...' (Zijp 2013).

The only issue was that Fab Labs elsewhere followed a model developed by Gershenfeld and colleagues at MIT that required specified set of equipment that cost €100, 000 (a suite of versatile tools that enabled people to make almost anything, and share designs and instructions between workshops using compatible software and tools). Other FabLabs usually secured external funding for this investment. Most of the work at De War so far has been self-funded. Initially, they decided to go to the local chamber of commerce, the local innovation centre, and the municipality to see whether they could get some funding for the digital fabrication machines, considering that they already had a space and several volunteers that were happy to be lab managers. Although the institutions approached were generally interested in the idea, they wanted to know more about their business plan. Talks went on for a while but no funding materialised in the end (Zijp 2013; Fieldwork notes, Amersfoort Fab Lab, 25<sup>th</sup>-31<sup>st</sup> October 2014).

A few months later, the team came across a laser cutter (see image below) on Marktplaats.nl that was advertised for 3000 Euros - a price that they could afford. Initially, the fact that the machine came from China did not deter them. When it arrived, they soon realised they were unable to make sense of the manual and warranty because it was written in Chinese. They invited the seller to demonstrate the machine and, despite the lack of a manual, they became convinced that they could make it work. Five friends (including Diana and Harmen) decided to put some money together to buy it. The laser cutter enabled the group of friends to build their own 'Ultimaker' 3D printer and a small CNC milling machine. Later on they found a cheap foil cutter. With these tools they were able to open up the Fab Lab to the public in 2010.



The group of five friends grew into fifteen in 2011, when a space on the factory premise became free in which they could move the lab. Since then, they have been approached by Fab Labs and other people globally who wanted to know how they set up their lab without any funding, the so called 'Grassroots Fab Lab' (Zijp 2013; Fieldwork notes, Amersfoort Fab Lab, 25<sup>th</sup>-31<sup>st</sup> October 2014) approach was born. They have also set up 'FabFuse', an annual international conference that takes

place in De War to share knowledge about such a grassroots approach to setting up and running a Fab Lab. Over the last years about 140 people have participated in the event, and in keeping with the collaborative spirit of peer production, around a quarter of participants helping create the content.

'We use mostly self-built and open source machines. We plan to have our whole lab open source as soon as possible... The focus of Fab Lab Amersfoort is on recycling of materials. We want to become a sustainable Fab Lab' (Amersfoort Fab Lab website).

From the beginning, Diana and Harmen wanted to combine the idea of personal fabrication to make almost anything with their grassroots approach, including values derived from sustainability and open source. Over the years, they have widened the approach of personal fabrication, linking their Fab Lab to ideas coming from Transition Towns, peer-to-peer societies (drawing on Michel Bauwen's ideas of a new economy) and citizen science (such as Public Labs). For instance, soon after setting up the Fab Lab, Diana, Harmen and a few others had the idea of creating a Transitielab (i.e. a lab that tried to combine aspects derived from Fab Labs with Transition Town approaches to create small-scale solutions that concern recycling, sustainable energy, biodiversity and sustainable food production) and a Repair Cafe (i.e. a meet up once every two months where people come to repair things together, and which typically attracts around twenty five people).

At De War people do not only think about sustainability and peer-to-peer societies within a Fab Lab setting – they also materialise these ideas.

The university 'is a place where all research comes together. Independent researchers that are not necessarily connected to a university are welcome here, as well as inventors, and artists that engage in independent research. It is also a place where research that has lost its place elsewhere in society can be done' (De War website).



Whilst setting up the Fab Lab in 2010, their interest in research and science led to another regular activity, the Studium Generale Amersfoort, a series of lectures where they would invite research scientist to talk about their work (such as crowdsourcing and bio-art). A year later this lecture series evolved into the establishment of the independent 'Universiteit Amersfoort' also based around the De War site.

Over the past thirteen years, more than two hundred people have collaborated in the projects of De War (Academic researcher B, interview, 30<sup>th</sup> October 2014). There is currently a mix of people involved. Some of them live on the premises (such as Diana and Harmen), or rent a space above the Fab Lab to work on their own projects such as one of the Fab Lab managers who works on solar boats, and another who experiments with PET bottles as construction materials. Others drop in and out of activities in De War such as being part of a temporary communication group, thinking about appropriate organisational structures or organising the yearly FabFuse event (see image below).

Some participants believe in the ideology of De War, and help out without necessarily having their own specific project. In addition, a group of ten people have volunteered to be Fab Lab managers. Many have built the machines in the lab, and now look after the visitors to the lab (from students, to one time visitors, to regular attendees). Some of them also are more actively involved in other De War activities.



At least two people who started to get involved in Fab Lab activities have now either created their own company or are employed in companies relating to digital fabrication (Fieldwork notes, Amersfoort Fab Lab, 25<sup>th</sup>-31<sup>st</sup> October 2014).



For several years, Diana and Harmen have developed the idea to buy the factory and its premises in order to be able to create a place where it is possible to fully experiment with ideas of being self-sufficient within a peer-to-peer society. In order to enter negotiations with the local municipality, they set up a cooperative in 2012 (called Plan B) and have developed more detailed structures to run it since 2014. There currently are fourteen members that make up the cooperative and use about five buildings on the factory premises that they rent from the local authority: the factory offices in which five people permanently live (including Diana and Harmen) and additionally, the SpullenLab (a workshop and theatre) and an office and meeting space that can be rented. Then there is the Fab Lab (see image below) with studio spaces on the second floor and communal gardens in front of it, storage buildings for all sorts of 'spullen' and a large warehouse where the local food cooperative rents a space.



### Change and transitions towards sustainability

From the beginning, Fab Lab Amersfoort had some distinct aims that varied from other Fab Labs in the network. For instance, issues of sustainability were always part of their core ambitions. Although Harmen feels that there is a potential link between sustainability and Fab Labs, current discourses in that vein seem to be too hyped up for him, considering that these relations are not as straightforward as they are made out to be in the media. In addition to issues of sustainability, the people from the Fab Lab Amersfoort are also keen to have a lab that works with open source principles and mainly relies on its own financial resources. Another distinctive aspect to Fab Lab Amersfoort is that they have actively announced that their ambition is to change society: 'don't wait for society to change, change it yourself, start small' (Wildschut 2013). Over the years, the Fab Lab has therefore become a place where the aim of personal fabrication (to make almost anything) was broadened out to ideas coming from citizen science, sustainability (in particular Transition Towns), open source and peer-to-peer thinking. For Diana, this broadening of aims also derived from the realisation that a lot of the people who use the Fab Lab actually just make 'nonsense' (such as key rings) rather than develop meaningful social and environmental projects (Fieldwork notes, Amersfoort Fab Lab, 25<sup>th</sup>-31<sup>st</sup> October 2014).

'I think Fab Labs are still narrow minded in a sense that they focus on production and this limited set of digital tools but there are a lot of viable interfaces to connect to others' (Wildschut 2013).

There was a Transition Town in Amersfoort, but it was mostly about talking, but doing nothing. So we started Transitielab. For people who wanted to make their own solutions for sustainability' (Wildschut 2013).

The Transitielab that was established shortly after setting up the Fab Lab is an example of trying to combine personal fabrication ideas with Transition Town ambitions and in the process redefining and broadening the Fab Lab approach. The people from the Transitielab used to meet up every Thursday (during the last few months, meetings have been less regular but plans exist to conduct a few workshops in the near future) to do sustainability related projects with a DIY twist. Diana, who had joined the local Transition Town group, mainly initiated the creation of this lab. She felt rather frustrated with the local group as they mainly talked about the issues rather than getting involved in doing something about it. In the Transitielab, people therefore decided to get on with projects and not talk until lunch in order to avoid just chatting about sustainability related matters. Projects have been varied and have fallen under the topics of energy, food, awareness and reuse, such as 'The Sunflower Energy Solution', the 'Mushroom Garden', jewellery out of Fab Lab plastic waste (see image below) and 'keeping bees'. For Harmen, the link between Transition Towns and Fab Labs is important. He regards Transition Towns as a way of connecting with the community and building local resilience for their locality, whereas Fab Labs mainly provide tools and technologies but often for personal projects rather than community building. During the Fabfuse event in 2012, Diana initiated discussions about trying to combine these two approaches.



Linking sustainability ideas with peer-to-peer thinking, open source, citizen science seems to be novel in itself but actually trying to materialise them in day-to-day projects is fascinating.

'Science is about research and developing new stuff or finding out new stuff that was not known before. And the people who come into the Fab Lab usually have the tendency to be interested in that kind of stuff as well... I think there is a link with Fab Lab there... and it is a laboratory, it is in the name and in the environment, there is some equipment there to do research' (Zijp 2013).

A similar connection is being forged with Citizen Science and Public Lab ideas and approaches to broaden Fab Lab aims. Rather than building things for people's own consumption, the idea is to build instruments that can be used to measure, for example, environmental impacts. Both links make sense when considering Diana and Harmen's interest in producing art installation that work at the intersections of science, art, technology and sustainability. In particular, the bee project has been a constant source of inspiration in this area (see image below). Diana has around ten beehives up on the roof of the Spullenmannen for which she has built the boxes and the material where the bees build their honeycomb in the Fab Lab. Beekeeping is not uncommon in the Fab Lab network specifically when members in the lab are interested in sustainability issues. In addition to building some of the material, Diana has collaborated with Utrecht University to create various sensors (such as temperature) that measure the well being of the hives. She has also advocated the need for similar beehive projects in the local area (Fieldwork notes, Amersfoort Fab Lab, 25<sup>th</sup>-31<sup>st</sup> October 2014).

Through this work, connections were forged with the local sustainability department within the council. When a council project came up to develop sensors to measure various local environmental changes (such as flood levels), De War was asked to conduct the work. After long discussions, the work was recently agreed and the project will start soon. Diana still needs to think through the details, but the idea currently is to create various citizen groups for the different project related areas such as the development of the software or the construction of monitors. The idea is also to organise workshops where people could debate various aspects of scientific data and measurement in order to develop some valuable science data collected by citizens. All the designs and measurement would be open source (Fieldwork notes, Amersfoort Fab Lab, 25<sup>th</sup>-31<sup>st</sup> October 2014).



'There are a couple of interconnected, intertwined core themes, and one is sustainability or resilience, local resilience, like Transition Town input. The other one is about open source development, which is more the Fab Lab input. The third one is grassroots organisation or peer-to-peer phenomenon, and building networks that empower individuals' (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014).

All these activities are set within an experiment of trying to create a peer-to-peer society that influences modes of ownership, production and governance within societies. Peer-to-peer (P2P) is based on distributed network approaches where people work freely on common goals and outcomes in projects whilst sharing information, resources, knowledge and outcomes (i.e. the belief that they belong to the commons). There is no centralised intermediary that coordinates the activities but consists of flexible hierarchies and structures. Participants freely make connections and take on board tasks and responsibilities. Anyone can participate as long as they have the skills and knowledge to contribute to a common endeavour. The validation process regularly occurs through

Using the Fab Lab to develop open source monitoring technologies is one possibility to link Fab Labs with sustainability issues... maybe there are others?

Does a peer-to-peer society encourage pathways to sustainability?

reputation and demonstrating these skills. Many of the organisational principles derive from the free software movement.

When speaking to Harmen about De War and its activities, he refers to Michel Bauwen's writings on peer-to-peer. He particularly focuses on Bauwens' (2012) efforts to draw out the 'similarities between the slavery-to-feudal transition and the capitalism to P2P transition'. According to Bauwens (2012), in both transitions the logic of the whole (and mainly social) system is fundamentally changed. The move from slavery to feudal was marked by a time where slaves became serfs. Instead of relying on 'conquering lands depleting their populations for slavery... Feudalism was a retreat to the local, to the manor, but within that manor, serfs could' have certain rights, producing 'directly for use value not for a monetary economy'. Bauwens has predicted a similar transition within the current world system from capitalism to a P2P. He reckons that the current challenge within a capitalist global system is based on 'hitting ecological, energy and natural resource limits' and has therefore foreseen that there will be a 'return to the local' that is characterised by a P2P society:

- 'The relocation of the economy will be matched by the globalization of intellectual and spiritual cultures... Global-local open design communities will co-exist with more localized production communities and enterprises' (Bauwens 2005).
- 'No longer relying on the ownership of the means of production, hiring workers to create value, but rather, they create proprietary platforms to enable and empower sharing and peer production to occur' (Bauwens 2005).
- 'Unlike the traditional workers who had no means of production and had to sell their labour, the emerging class of knowledge workers does again own its means of production' (Bauwens 2005).
- 'There will be a shift from extensive material development, to intensive immaterial development. The core logic of the creation of immaterial cultural, intellectual and spiritual value in this coming world of open design, will be non-reciprocal peer production' (Bauwens 2005).

'Now we are really actively looking for a way to get in touch with more initiatives like ours... we can make a hub of the house' (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014).

'And that's recognising that we're not the only ones trying to do this, but there's other places in the world as well, and it's nice to connect, reach out and collaborate, although it is not necessary at all, because you can just run your own thing without doing this' (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014).

For Harmen in a P2P society, people will be less connected to work systems where the economy is driven by growth but rather engage in activities because of personal motivations and interests. With such a shift of emphasis, for him, people will start to question existing power relations and ways of working and subsidise these with self-organising and horizontal distribution processes (Fieldwork notes, Amersfoort Fab Lab, 25<sup>th</sup>-31<sup>st</sup> October 2014). Although activities within De War are structured in different ways (Academic researcher B, interview, 30<sup>th</sup> October 2014), they all try to explore such P2P ideas in relation to governance, ownership and production. Similarly, Harmen's interest in being involved in a local group that thinks about distributed ways of setting local agendas and making decisions (based on David van Reybrouck's book *Against Elections*) are attempts to explore different ways of anticipating self-organising structures in society and 'hacking systems' (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014). Harmen feels that 'keeping this in mind helps to make decisions in day to day life'. It is about holding onto shared values and ambitions as a way of making

decisions together and realise different ways of living. The difficulty of this endeavour is that these ideas have been realised within immaterial, virtual and software related projects but are only slowly moving into developments in hardware.

'The key question is: can peer to peer be expanded beyond the immaterial sphere in which it was born?' (Bauwens 2005). In particular, the issue of the material survival of P2P participants has not been solved. It therefore still heavily relies on market related processes i.e. having a job outside the P2P activities (Bauwens 2005; Academic researcher B, interview, 30<sup>th</sup> October 2014). Such dynamics can also be observed in De War. The plan to buy the factory and its premises from the local authority is part of the overall vision for De War - to develop a space where they can experiment and establish P2P projects, drawing on sustainability, art, science and technology related issues and creating a hub of local activities. Architectural drawings and plans have been drawn up to visualise these ideas (see image below). The Fab Lab, theatre, exhibition and work related spaces would still exist, in addition to creating a café, several biodomes and a biosphere on top of the roof of the factory. At the moment, the cooperative suspects that the ground in and around the premises is quite polluted because of past factory activities, hence the plan is to develop various projects with the university to find ways for plants to clean the soil.

Interesting how the people of De War address issues of sustainability through various different activities: the interactive artwork, the provision of space to realise projects, the creation of visions and their materialisations of possible futures, etc.



### Experimenting with approaches coming from peer-to-peer

In general, Fab Lab Amersfoort is an open space for people to work and collaborate on projects where decisions are made through discussions and mutual agreements. The more you contribute to the running of the lab, its maintenance and the sharing of knowledge, the more access you have to the machines and space. This idea of people taking responsibility for the space and their own learning runs through the lab's governance, norms and activities. Regular and one off visitors and also Fab Lab managers are required to contribute to the lab (in return they gain free access to the lab all week), which can take several forms. On arrival (and by looking on the website) newcomers get this idea very quickly, as they are asked to pay 50 Euros to be able to use the space and machines that they can earn back through sharing their design in the form of a FabMoment (a website based template to share projects), conducting maintenance work or developing the existing machines (i.e. repairing or building them or creating manuals for others) (Fieldwork notes, Amersfoort Fab Lab, 25<sup>th</sup>-



31<sup>st</sup> October 2014). The visitor is not obliged to earn back the money but instead is able to pay for her/his visit (see image below).



Visitors are welcomed by one of the Fab Lab Managers. Currently, there are about 10 Fab Lab managers, who meet up about once a month to discuss a diverse set of issues that have come up in relation to the lab. This group of people has derived from the previous networks that have been created, in particular, through the OpenToko workshops, and have provided a steady stream of managers, who keep the lab open to the public once a week on a Tuesday. In return for volunteering and keeping the lab open, they all have free access to the technologies for the rest of the week. During the open days, at least one manager is in the Fab Lab, either working on his/her own projects or helping others to get started and with particular enquiries.

'You will have to at least try and figure things out yourself or with fellow visitors' before approaching the lab manager (Fab Lab Amersfoort website, <http://www.fablabamersfoort.nl/en>).

On the whole, there is strong enthusiasm for autodidacticism when it comes to learning processes in De War. In particular, for Diana being an autodidact is connected to feeling empowered, something that is important for her to translate in what she does and others can potentially find within themselves within De War. The sharing of knowledge is constantly aspired to within the Fab Lab by encouraging people to earn back the 50 Euros through sharing their designs as FabMoments on the Fab Lab Amersfoort website but also more indirectly in the ways the lab is run. Fab Lab managers try to create a supportive environment in which they provide support when needed; nonetheless they are keen to leave people to work things out by themselves. Harmen has affirmed this attitude by stating that he is keen for the Fab Lab not to become a 'copy shop' (Academic researcher A, interview, 19<sup>th</sup> August 2014) but a place where everyone is expected to contribute to sustaining the lab. Such efforts of sharing knowledge, helping each other to find out things nobody might not know about and encouraging people to learn and experiment for themselves runs through all the machines and activities in the lab.

During FabFuse in 2012, Harmen talked about the ideas behind running the Fab Lab through referring to a book called 'The Unstoppable Power of Leaderless Organizations' (see image below). 'If you chop off the head or legs [of a spider] it does not know what to do... the starfish on the other hand is like a decentralised organisation if you chop off one leg a new one will grow' (Zijp 2013). In practice this means, for example, when planning the FabFuse event 'no one was in charge or on top... there a whiteboard with to do items... people talk about topics... and common values... and people would tick off the list... and people who get frustrated there is a chance to change it'. For him,

When visiting De War such an approach to learning becomes apparent very quickly and that it suits several people involved. Autodidacticism might not be for everyone or the only way of feeling empowered? But it is definitely an interesting way to think about empowerment in relation to sustainability.



These ideas are based on the principle of 'don't organise, discuss values' (Zijp 2013).

it is about managing expectations, learning together how this way of working might work and in the process 'reinventing culture and society and dealing with each other in a different way' (Zijp 2013). There have been times where it has been difficult to hold onto these ideas. But they also create a space to come back to in order to re-evaluate particular challenging situations and discussions in the light of these shared ideas, norms and expectations.



THE UNSTOPPABLE POWER OF  
LEADERLESS ORGANIZATIONS

These ideas are shared across all of the organisations within De War (such as OpenToko) but play out in several ways depending on who takes part and the format of the activities (Academic researcher B, interview, 30<sup>th</sup> October 2014). More recently, these ideas have been translated into a constitution and several bylaws as part of setting up a cooperative for De War. With the ambitions to buy the factory from the municipalities came the need to create a legal body that could help the group to enter the negotiations. A cooperative was considered to be the most appropriate body to represent their ideas and norms, although, adopting the standard list of bylaws attached to cooperative did not seem entirely helpful. Consequently, the group of members spent a long time searching for lawyers able to help them develop an adapted, alternative constitution and set of bylaws (which had not been an easy process: lawyers felt uncomfortable signing such 'unconventional' bylaws). For the members it was important that these bylaws represented the group's values and norms of sharing knowledge and resources, self-governance, peer-to-peer working and decentralisation. In order to maintain these values and norms and manage expectations, four levels of collaboration have been outlined as part of the constitution where all of the members are able to position themselves (Academic researcher B, interview, 30<sup>th</sup> October 2014; Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014).

Level 1 and 2 are the lower levels of involvement, which constitute mainly in sharing knowledge, space, tools, machines and resources. Level 1 participants do not need to join the cooperative but also do not benefit from its legal form and members' ability to set up her/his own project within De War. Level 3 and 4 require higher levels of involvement from the members. Level 3 members commit themselves to maintain the internal network of the cooperative, deciding on visions for De War, finances and the development of the facilities. Level 4 members share these responsibilities but also are involved in external work such as creating collaborations with initiatives (locally and globally) that have similar aims and ways of organising (such as Voedselkollektief, a local food initiative that is also based in the factory). There will be two sub-committees consisting of the members: one that develops a vision for De War and the other that tries to create connections with other initiatives. At present, there is no formal procedure to monitor whether members keep up with their contributions and

The process of working through the various bylaws to set up a cooperative reveals that initiatives such as De War have to work through technical and legal issues that are peripheral to mainstream practice, making the exploration for possible sustainable future even more complex – here the idea of 'hacking systems' becomes valuable one.

responsibilities outlined in their chosen level (Academic researcher B, interview, 30<sup>th</sup> October 2014; Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014).

'We found out that it is really a lightweight thing to organise, and it is very valuable, but that as soon as we stop doing it... organising it, yes. No one steps in... It hardly gets copied either... I really don't know if this is because people feel they cannot step into our core ground.' (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014)

'She finds it very necessary to collaborate and give back to society but she does not see herself as a person in a role where I am going to create my own project... these kind of environments are still not able to cater to everyone's needs' (Academic researcher B, interview, 30<sup>th</sup> October 2014).

'You have to step in and do your bit. That you have to accept that probably you will not get praise for it anyway... And that you have to do it because you benefit from it yourself' (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014).

The formulation of a constitution and its bylaws has been a rather recent development within De War. Although this constitution derived through a collaborative process, in day-to-day life at De War some of the people find it easier to translate these norms and responsibilities than others. When talking to some of the people involved and participating in some of the activities, it seemed that over the last few years there has been a process of growing from a group of friends to a network of interconnected activities whilst trying to keep particular ways of making decisions and working together alive and incorporating them into the organisation's core values. Within this Diana and Harmen have found it difficult not to be considered to be the 'leaders', as they initiate a lot of the activities, live on the premises and constantly work hard (with great persistence and reflection) on realising the ambitions of De War. They would appreciate it if more people would become more fully involved and cannot quite understand why people consider them as the leaders.

Even so, some of the people have found it difficult to engage with the structure of De War and make sense of the varying levels of perceived authority (Fieldwork notes, Amersfoort Fab Lab, 25<sup>th</sup>-31<sup>st</sup> October 2014; Academic researcher B, interview, 30<sup>th</sup> October 2014). Consequently, these participants have expressed being unsure about their role and corresponding responsibilities. For instance, one of the De War members mentioned that she used to be a lot more engaged in the general activities of De War (because she believed in what people were trying to achieve) but nowadays less so because she felt that she needed to have her own project to be fully involved. Moreover, it is difficult for her to combine her daily work and leisure commitments with the activities within De War. She appreciates the informality of the place but is also unsure about her role and how much time she can actually commit to it.

According to Harmen, people who have their own project within De War (such as Fab Lab manager, a who builds solar boats (see image below), or one of the De War members who works on PET bottle structures) and invest time and money in it (such as through renting a space) often find it easier to find their own role within De War in relation to their commitment to it and its norms (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014).



'I think this is really the core of everything, that we are building culture, a culture, and that is open and that's inclusive, for anyone who wants to participate, but does have positive filters in place. So you cannot get anyway with anything, although it is open to anyone, you know, and that provides a friendly community that gives nudges and helping hands wherever needed, but allows you, or stimulates you empower yourself making use of that' (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014).

'We made lots of friends who taught us and now we can do it ourselves but we were also lacking people who can make and design things and fabricate them so that is why we set up a Fab Lab' (Wildshut 2013).

The empowerment of people (and finding the means to empower yourself) is actually key to De War's norms and activities, which can connect to having your own project. Later on in the conversation Harmen pointed out that all of the mentioned people have not left De War yet and so it still is to be seen how these dynamics will influence in how far people feel connected to De War and stay or decide to leave.

In addition to its members, De War activities also link up with external initiatives that have an art, science or sustainability focus. For instance, the local food sovereignty initiative (called Voedselcollectief) is separate from De War's activities but has its base on its premises and a lot of the people from De War are involved in it. The people within De War create links with external networks and groups through participating in other activities. For example, one of the Fab Lab managers regularly comes to the Fab Lab and helps out at the Repair Café, but is also heavily involved in the Dutch Hackerspace scene. The forging and overlapping of networks where internal and external boundaries become blurred has become quite a purposeful undertaking within De War. It is a form of sharing knowledge and resources in an open manner (Fieldwork notes, Amersfoort Fab Lab, 25<sup>th</sup>-31<sup>st</sup> October 2014).

Over the years, Diana and Harmen have more purposefully set up several networks and associated projects in De War, starting from the OpenToko to Studium Generale. When talking to Diana and Harmen, it seems that a lot of their learning and experiences have been shaped by them trying to overcome several obstacles (such as not getting into exhibitions, lacking certain knowledge to realise ideas or not gaining funding) and persisting with their efforts (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014). Over the years, they have started to utilise this approach more and more, whilst relating it to ideas of 'hacking systems' (Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014) and not just things. Through these experiences Diana and Harmen have formulated several lessons that they have presented to several audiences:

- 'Don't wait for funding, Do it anyway and Do it yourself and Do it open source'
- 'Don't wait for approval, do it Anyway and do it with others'
- 'Don't finish a detailed plan, don't wait until you have convinced yourself of a destination start moving'
- 'Don't wait for society to change, change it yourself, start small'

(Zijp 2013). Within the Fab Lab network, these learnt lessons have been associated with a grassroots approach to setting up and running labs, which is outlined in greater detail within 'The Grassroots Fab Lab Instructable' (i.e. 'how to set up a Fab Lab in 7 days with 4 people and about €5000') that can be freely downloaded from the internet (produced by Harmen and Fab Lab Amersfoort: <http://www.fablabamersfoort.nl/downloads/fablab-instructable.pdf>). In addition, this approach was presented at several conferences (such as FabFuse 2012 and Fab6 in Amsterdam) and the Fab Lab has been approached by others asking for their support and help in setting up these types of labs. Nowadays, these activities have been reduced mainly because of attempts to broaden out the Fab Lab idea of personal fabrication into local networking activities. FabLab Amersfoort feels less the need to connect with the global network. Other networks, such as the Open Hardware Conference (see image below), have become more relevant to the projects that they have been involved in.

Learning about community building can be even more demanding than the acquisition of technical skills. This is relevant seeing that for Amersfoort Fab Lab transformation rests in the new built relationships built through their networking activities.



Fab Labs around the world still contact the people from the lab to enquire about their grassroots' approach. These interactions are less connected to the Fab Foundation and general network activities. Regular enquires about the approach usually come from labs in Brazil, Ethiopia and India, asking Diana and Harmen, in particular, to talk about their self-funded way of working and projects around sustainability in the lab (Fieldwork notes, Amersfoort Fab Lab, 25<sup>th</sup>-31<sup>st</sup> October 2014). Harmen sometimes feels uncomfortable talking about recycling and reuse to this audience because he reckons that knowledge and ideas within this area is much greater in a developing country context than what they could gather over the last years from Amersfoort. People often also show an interest in the 'Tweak Show' when getting to know the Fab Lab and relate these art activities very much to what is happening in De War. Currently, Diana and Harmen work on the idea of creating a 'Peer Lab' course where people from the network can learn about their grassroots approach in ways that emphasise the self-funded, open knowledge, social and sustainability aspects of their lab, rather than training in the technologies involved (which is typical in the Fab Academy of the Fab Foundation based at MIT) (Fieldwork notes Amersfoort visit; Diana Wildschut and Harmen Zijp, interview, 30<sup>th</sup> October 2014).

### **Reflections on energy demand and Amersfoort Fab Lab**

The connection between Fab Labs and innovation for low energy demand may not be immediately obvious. When thinking about energy demand and resource use it is reasonable to focus attention on immediate and intensive activities, such as heating homes or offices, or making energy using products more efficient. However, if we think about the energy used to make and distribute the products used in those built environments, then links with digital fabrication, and its possibilities for making and fixing, become less tenuous. Products 'embody' energy demand in terms of the energy resources required to mine, process, manufacture, and distribute them. As products break and become discarded, so further energy is demanded in the production of replacements.

Moreover, whilst digital fabrication could potentially enable local production, remanufacturing, and increased longevity in goods and services, with implications for energy demand, digital fabrication could also lead to throw-away, personalised manufacturing that intensifies energy consumption. Moreover, decentralisation may reduce scale efficiencies, and require more dispersed logistics infrastructures in raw material shipping. So the relationships between the new forms of production and consumption experimented in Fab Labs and energy demand are very ambivalent.

This ambivalence makes Amersfoort Fab Lab such an interesting place to visit in order to explore how relations between forms of production and consumption play out in day-to-day digital fabrication settings. They experiment and materialise ideas around sustainability in several ways through the interactive artworks (engaging people in climate change debates), the projects in De War (finding

alternatives ways of making and consuming), the infrastructures and visions for De War (providing a space to experiment and creating visions for sustainable alternatives) and the networks that they create (linking people and initiatives interested in personal fabrication, peer-to-peer and sustainability).

Examining this list, what becomes apparent are glimpses of the more social rather than technical aspect of digital fabrication within community workshops. Fab Labs (such as the one in Amersfoort) have an emphasis on sociability, skilling, sharing, and being part of something. These labs are not solely about making objects. Rather, the fabrication of objects brings and holds together and embodies a lot of important social relationships in the making. Any prospects for intervening in grassroots digital fabrication and attempts to steer activity towards lower energy innovations and goals will need to take account of these social relations, which require an additional, broader view on energy demand compared to embodied energy alone.

At the Amersfoort Fab Lab, the facilities are used to make objects such as monitoring systems and beehives in order to explore ideas around sustainability but additionally, the way they are trying to insert the innovative sustainability possibilities of Fab Labs into Transition Town activities and in other directions of change they seek (such as citizen science, and an open, collaborative and sustainable society generally) is by embedding the lab into networks of local activity that are working in similar directions. Transformation rests in the new relationships built through these networking activities. Here, sustainability and low energy demand issues are not solely framed in relation to examining the potentials of socio-technological innovations but particularly experimenting with change through building novel relationships between people. It is the organisation of these activities, and how they connect to bigger ideas and community building that is important.

We are currently organising a workshop around low energy demand and grassroots digital fabrication with Amersfoort Fab Lab to explore some of these networks, activities and projects. Please get in touch with the project team if you would like to participate or provide any comments.